Some of the ecological results are as follows. Ruppia is called a water halophyte, living in salt water that would produce plasmolysis in fresh-water plants, but unable to live in water of the open ocean. The hydrophytic responses of the shoot are the weak and spreading form, the absence of stomata, the production of slime, the numerous air spaces, the lack of mechanical tissue, and the reduction of the vascular system to one axial bundle and two lateral ones in both stem and leaf. The responses of the root are a reduction of the system to small unbranched roots borne singly at the nodes, the presence of air spaces, and the concentric axial bundle. The axial and cortical bundles are thought to be useless hereditary structures.

Some of the facts in reference to the reproductive structures are as follows. The inflorescence is a reduced spadix, and a small spathe is present, which is said to have escaped the notice of investigators almost entirely. In the development of the microsporangium a large archesporial group of cells is differentiated, which later becomes septate. In the development of the megasporangium, usually only one layer of parietal cells is formed, and in one case two functioning mother cells were observed in a sporangium. The count of chromosomes was made in the microsporangium and in the reduction divisions of both gametophytes, and was found to be eight and sixteen. The male cells are produced before pollination, which is accomplished by means of the water. The endosperm is scanty, never being more than a thin layer lining the sac. The proembryo is a filament of three or four cells, the basal one becoming much enlarged to form the suspensor. The three embryo-forming cells produce at first a spherical group of cells, and it is believed that both cotyledon and stem tip are derived from the terminal cell of the proembryo, the two other cells producing the hypocotyl, adventitious root, and primary root, the last organ never functioning.

The paper contains a large amount of information in reference to a very interesting form, and the plates, some of them photomicrographs, reproduce the structures in such a way that every botanist can make his own interpretations. —J. M. C.

Orchid flowers and formative stimuli.—As a product of his visit of three months at the Buitenzorg Garden, FITTING published in the initial number of the new *Zeitschrift für Botanik* an account of his experiments on the effect of pollination and other stimuli upon the postfloration behavior of the flowers of orchids.[22] The tropical orchids, available in great abundance at this garden, are especially suited for experimental study on this point, because the difference in duration of pollinated and unpollinated flowers is sufficient to give opportunity for experimentation with unequivocal results, whether the postfloration processes are autonomous or induced. Of these processes he distinguishes four : (1) premature fading; (2) closure of the stigma and swelling of the gynostemium; (3) swelling of the ovary; (4) greening of the perianth.

[22] FITTING, H., Die Beeinflussung der Orchideenblüten durch die Bestäubung und durch andere Umstände. Eine entwickelungsphysiologische Studie aus den Tropen. Zeits. Bot. 1:1–86. *figs.* 27. 1909.

He was able to induce premature fading by applying most various substances to the stigma: besides their own living pollen, volcanic river-sand, spittle, dead pollen and pollen extract, dead and leached pollen of the same species or of other genera or even of other and remote groups, and extract of gynostemium tissues induced it, and apparently also 5 per cent. saccharose. He was not able to determine what the chemical agent or agents were in these reactions. Wounding the stigma or the tissue at the apex of the gynostemium also caused premature fading. Closure of the stigma and swelling of the gynostemium could be effected by bestrewing the stigma with living or dead pollen of orchids (any genus) or even of Hibiscus, and with the alcoholic extract of pollen. On the contrary, dead pollen and pollen extract had no effect or the very slightest in inducing swelling of the ovary, which occurred only when living pollen germinated on the stigma and its tubes grew into the ovary. The greening of the perianth (peculiar to certain species) appears only when the ovary has previously begun to swell and to turn green.

FITTING considers fading as the end process of floral development, simply released by the pollen stimulus or others earlier than it is autonomously. The stimulus, however, does not merely hasten development; it diverts its course, for a perianth half open and quite incompletely developed may be made to fade in twelve to twenty-four hours by a stimulus which proceeds from the distant stigma. This also offers a new example of the separation of perceptive and reactive regions. The closure of the stigma, etc., appears to be strictly a case of chemomorphosis, but the agent does not produce any effect on the ovary, whose growth and formation of ovules, and so the consequent greening of the perianth, depend on the penetration of the pollen tube; but whether the stimulus is mechanical or chemical does not appear.

The prompt fading of the flowers, possible after an insect bite on the stigma or after stimulation by foreign pollen, and the small crop of fruit on these tropical orchids, awaken doubts in FITTING'S mind as to the validity of the teleological interpretation of the elaborate mechanisms which are believed to secure cross-pollination. Perhaps they were effective in a past age when insect life was richer, he adds by way of apology for his temerity in suggesting such heresy. He will find this heresy not unwelcome, we imagine, in this country, where ecologists are questioning whether there is even adequate proof that cross-pollination is advantageous.—C. R. B.

Cytology of Oenothera.—GEERTS[23] published an account of embryo-sac development and chromosome reduction in Oenothera. A row of four megaspores is formed, with typical reduction phenomena, the megaspore nearest the micropyle forming the embryo sac. Its nucleus divides only twice. Both

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[23] GEERTS, J. M., Beiträge zur Kenntnis der cytologischen Entwicklung von *Oenothera Lamarckiana*. Ber. Deutsch. Bot. Gesells. **26a**:608–614. 1908.

———, Beiträge zur Kenntnis der Cytologie und der partiellen Sterilität von *Oenothera Lamarckiana*. Separate (source unknown). pp. 116. *pls. 5–22*. 1909.